

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-106514

(43)Date of publication of application : 22.04.1997

(51)Int.Cl.

G11B 5/39  
H01L 43/00

(21)Application number : 07-259938

(71)Applicant : FUJITSU LTD

(22)Date of filing : 06.10.1995

(72)Inventor : UZUMAKI TAKUYA  
YAMAGISHI WATARU  
KOBAYASHI KAZUO

## (54) FERROMAGNETIC TUNNEL ELEMENT AND ITS PRODUCTION

## (57)Abstract:

PROBLEM TO BE SOLVED: To produce a magnetic sensor having excellent characteristics showing large change in the resistance in a weak magnetic field with good production yield by forming a tunnel joint of a three-layer structure of ferromagnetic layer/ insulating layer/ferromagnetic layer and forming an antiferromagnetic layer on the outside of the one ferromagnetic layer of the tunnel joint.

SOLUTION: A Si substrate is laminated with a Fe film 2 as a ferromagnetic film, an alumina film 3 as a tunnel insulating film, a Fe film 4 as a ferromagnetic film, and a FeMn film or NiMn 5 as an antiferromagnetic film. Since FeMn grows as  $\gamma$ -FeMn on NiFe, it shows antiferromagnetism in an As-deposited state. On the other hand, NiMn is not antiferromagnetic in an As-deposited state but forms a regular grating by heat treatment and changes into an antiferromagnetic material. Therefore, the element having NiMn is heat treated in vacuum.



## LEGAL STATUS

[Date of request for examination]

19.08.2002

[Date of sending the examiner's decision of rejection] 05.10.2004

[Kind of final disposal of application other than the  
examiner's decision of rejection or application  
converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of  
rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

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